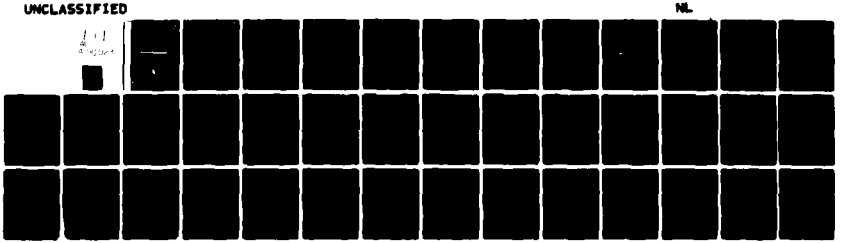
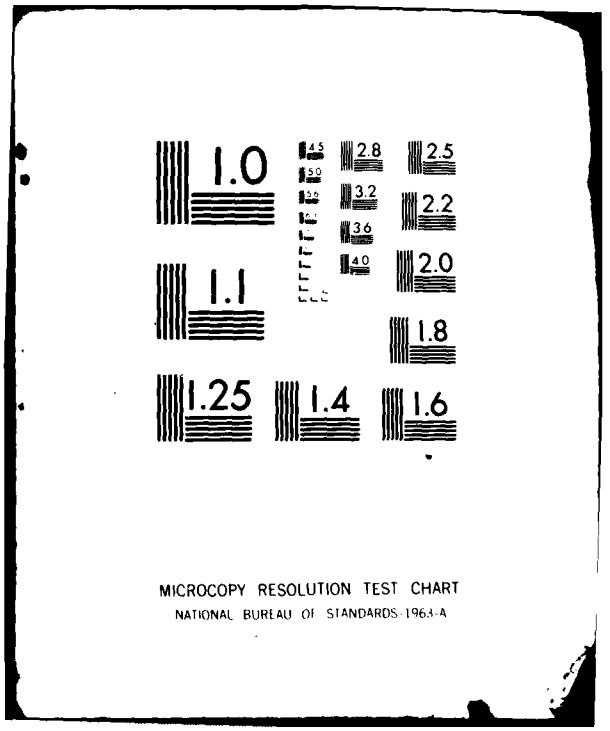
AD-A110 023 HAMILTON TECHNOLOGY INC LANCASTER PA F/G 19/1
M577 FUZE P.D. HOUSING ASSEMBLY OPTIMIZATION.(U)
AUG 81 A L MEISSNER DAAK10-79-C-0169
UNCLASSIFIED NL

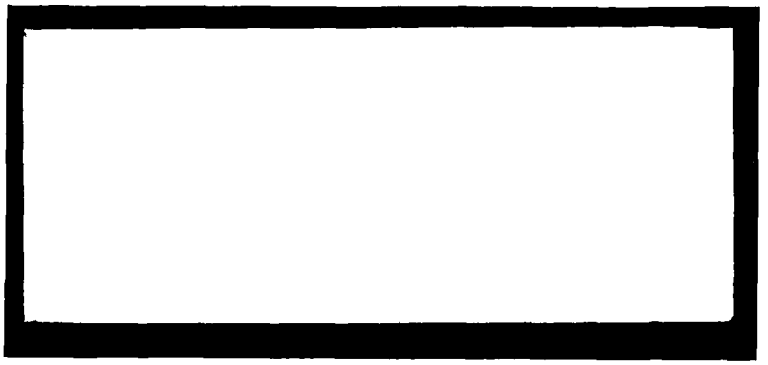


END
DATE FILMED
DTIC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

LEVEL II

(2)



Hamilton technology, inc.

a subsidiary of HMW Industries, Inc.
P. O. Box 4787, Lancaster, Pa. 17604

LEVEL II

(2)

FINAL REPORT

FOR

M577 FUZE

P. D. HOUSING ASSEMBLY

OPTIMIZATION

PREPARED FOR

ARRADCOM

BY

A. L. MEISSNER

HAMILTON TECHNOLOGY, INC.
P.O. BOX 4787
LANCASTER, PA 17604

AUGUST 13, 1981

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD A110 023 / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) M577 FUZE P.D. HOUSING ASSEMBLY OPTIMIZATION	5. TYPE OF REPORT & PERIOD COVERED FINAL REPORT AUGUST 1979 - MARCH 1981
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) A. L. MEISSNER	8. CONTRACT OR GRANT NUMBER(s) DAAK10-79-C-0169
9. PERFORMING ORGANIZATION NAME AND ADDRESS HAMILTON TECHNOLOGY, INC. P.O. BOX 4787 LANCASTER, PA 17604	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS TASK #4
11. CONTROLLING OFFICE NAME AND ADDRESS DEPARTMENT OF THE ARMY US ARMY ARMAMENT R&D COMMAND DOVER, NJ 07801	12. REPORT DATE 13 AUGUST 1981
	13. NUMBER OF PAGES 30
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)	15. SECURITY CLASS. (of this report) UNCLASSIFIED
	15a. DECLASSIFICATION DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVED FOR PUBLIC RELEASE - DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report describes the work done by Hamilton Technology, Inc., for ARRADCOM under Contract DAAK10-79-C-0169, Task 4, from August 1979 to March 1981. The objective of this task was to reduce the cost of the current Three-Module Assy., Loaded by eliminating parts and Assy's. The current P.D. Housing, which is a high cost drawn aluminum part, is replaced by a polycarbonate part. This was accomplished by combining the functions of the Counter Housing and the P.D. Housing into one part. Several parts and assemblies were eliminated.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

TABLE OF CONTENTS

Section		Page
1	INTRODUCTION	1
2	SUMMARY OF ACCOMPLISHMENTS	2
3	CONCLUSIONS AND RECOMMENDATIONS	3
4	TECHNICAL DISCUSSION	4
	4.1 Concept Description	
	4.2 Final Design	
	4.3 Method of Assembly	
	4.3.1 Counter Assembly	
	4.3.2 Detonator Holder Assembly	
	4.3.3 Three-Module Assembly	
	4.3.3.1 Assembly of Timer Housing Retaining Ring	
	4.3.3.2 Zero-Set Operation	
	4.3.3.3 Heat Stake P.D. Housing to Sleeve	
	4.3.3.4 Assemble Spacer and Clutch Grip Spacers/Rings	
	4.3.4 Loaded Three-Module Assembly	
	4.3.4.1 Assemble MDF	
	4.3.4.2 Assemble Detonator Holder and M55 Detonators	
5	TESTING	9
	5.1 Static Propagation Test	
	5.2 Jolt and Jumble Test	
	5.3 Five-Foot Drop Test	
	5.4 Ballistic Test	
	5.5 Detonator Holder Heat Stake Test	
	5.6 Ballistic Retest	
6	COST AND WEIGHT	11
	6.1 Cost Comparison	
	6.2 Weight Comparison	

APPENDICES

A. Drawings
B. Fault Analysis
C. Ballistic Test Reports

1 INTRODUCTION

This report describes the work done by Hamilton Technology, Inc., for ARRADCOM under Contract DAAK10-79-C-0169, Task 4, from August 1979 to March 1981.

The objective of this task was to reduce the cost of the current Three-Module Assembly, Loaded (#9236558) by eliminating parts and assemblies. The current P.D. Housing, which is a high cost drawn aluminum part, is replaced by a polycarbonate part. This was accomplished by combining the functions of the Counter Housing (#9236583) and the P.D. Housing (#9236564) into one part. Several parts and assemblies were eliminated.

2 SUMMARY OF ACCOMPLISHMENTS

The new design reduces the cost of the present Loaded Three-Module Assembly by reducing the number of components and assemblies. The specific areas of simplification in the new design are as follows:

(1) Eliminate the Counter Housing (9236583) and combine its function of MDF and Detonator Holder support with the P.D. Housing (#9236564).

(2) Eliminate the Counter Housing Skirt (#9236586).

(3) Eliminate the Housing Retainer (#9236584) and Washer (#9236585) together with their assembly operation.

(4) Eliminate the crimping of the P.D. Housing to the Sleeve (#9236631) and the Detonator Holder Assembly (#9236561) to the P.D. Housing.

Laboratory and ballistic tests were successfully performed on the fuze assemblies with the new design. The projected saving of the new design is $.37 per fuze.

3 CONCLUSIONS AND RECOMMENDATIONS

By eliminating parts and assemblies, implementation of the new design provides a projected savings of $.37 per fuze. Since the new design passed the qualification tests, it is recommended that this proposed change be incorporated into the M577 Fuze Technical Data Package.

4 TECHNICAL DISCUSSION

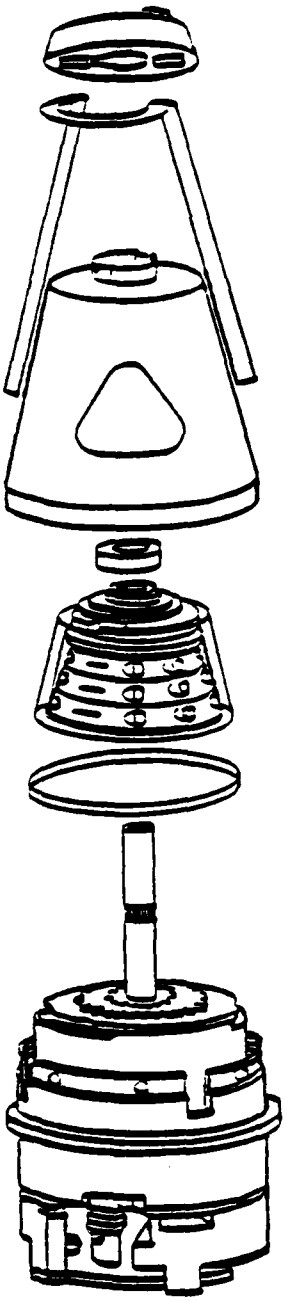
4.1 Concept Description

The current design uses a high cost drawn aluminum P.D. Housing and a polycarbonate Counter Housing. The P.D. Housing supports the Detonator Holder Assembly and the MDF; the Counter Housing contains the setting index line as part of the Counter Assembly (See Figure 4-1).

The new design utilizes a one-piece molded polycarbonate P.D. Housing together with a modified Sleeve, Counter Body, and Detonator Holder (See Figure 4.1). The P.D. Housing contains the setting index line and an internal spline to key into the Counter Body. Molded "snap" legs on the Housing mate with an internal groove in the Sleeve to provide an axial lock of the PD Housing and the Sleeve. Rotation of the P.D. Housing is permitted to achieve final setting. The proper position of the index line on the P.D. Housing relative to the Counter Assembly is retained by heat staking the Housing material into a slot in the Sleeve (See Figure 4-1). Channeling similar to the present P.D. Housing is provided on the outside of the proposed P.D. Housing to support and guide the MDF.

The Detonator Holder has been modified by adding legs which are snapped into the top of the P.D. Housing; thus, eliminating the staking operation of the P.D. Housing to the Sleeve. The Detonator Holder has four equally spaced ribs on the outside diameter to ensure that the internal taper of the ogive retains the Detonator Holder during handling.

PRESENT DESIGN



PROPOSED DESIGN

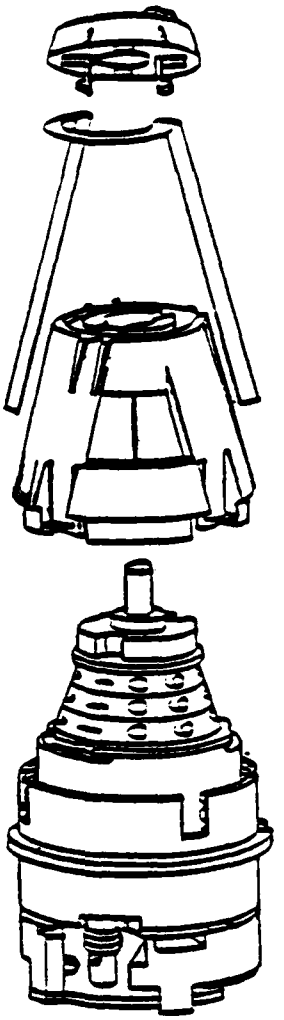


FIGURE 4-1

4.2 Final Design

The final design consists of a molded one-piece polycarbonate P.D. Housing and Counter Housing. The Detonator Holder, Counter Body, and Sleeve were modified to accommodate the new P.D. Housing (See Figure 4-1).

The polycarbonate P.D. Housing contains a channel for the MDF tape and a setting index line which was formerly part of the Counter Housing. An internal spline on the new P.D. Housing replaces the tabs on the present Counter Housing which keys to the Counter Body. The new P.D. Housing has four legs at the bottom which snap into an internal groove in the Sleeve, eliminating the crimping of the present P.D. Housing to the Sleeve. The proper position of the zero index line on the new P.D. Housing is retained by heat staking until assembly of the unit into the ogive. There is a shelf .360 in. wide on the new P.D. Housing to provide material for the heat staking. Two slots 180° apart in the top of the new P.D. Housing are used to hold the Detonator Holder Assembly in place (See Figure A-1).

The new Detonator Holder holds the Detonators and Firing Plate the same as the present design. The Detonator Holder has been modified in order to fasten it to the new plastic P.D. Housing. Two legs, each 90° from the detonator holes, protrude downwards on the inside diameter of the Detonator Holder. The legs of the Detonator Holder snap into two slots in the top of the P.D. Housing. There are four equally spaced ribs on the outside diameter of the Detonator Holder so that the internal taper of the ogive retains the Detonator Holder Assembly after final assembly (See Figure A-2). The crimping of the Detonator Holder Assembly to the present P.D. Housing is eliminated (See Figure 4-1).

The Counter Body has been changed to interface with the new P.D. Housing. Material has been added to the top of the Counter Body to provide deeper slots to engage with the internal spline of the new P.D. Housing (See Figure A-3).

In producing the final drawings two minor changes were made to the P.D. Housing to prevent damage to the MDF during assembly. These changes are:

(1) The channel for the MDF on top of the P.D. Housing was changed to give the MDF a larger radius as it is brought down the side of the Housing.

(2) A wall was added on the inside of the channel for the MDF at the internal spline location. This wall forces the one leg of the Detonator Holder into the internal spline of the P.D. Housing without allowing the leg to touch the MDF.

Prototypes reflecting these changes were built and tested satisfactorily in the laboratory.

4.3 Method of Assembly

4.3.1 Counter Assembly

New Counter Body plus standard Pinions, Wheels, Pinion Shaft, Spacer, and Retaining Ring are assembled and staked the same as production units. The Counter Housing, Housing Retainer, and Washer are eliminated.

4.3.2 Detonator Holder Assembly

The standard Firing Plate is heat staked to the new Detonator Holder using the production tooling with a modified nest for the new Detonator Holder.

4.3.3 Three-Module Assembly

4.3.3.1 Assembly of Timer Housing Retaining Ring

The new Sleeve has an added second internal groove for the P.D. Housing ahead of the Retaining Ring groove. In order to assemble the Timer Housing Retaining Ring, a new fixture providing a means of getting the Retaining Ring past the groove for the P.D. Housing was required.

4.3.3.2 Zero-Set Operation

The Counter Assembly is put on the Setting Shaft of the Three-Module Assembly without engaging the #3 Wheel with the Setting Gear Drive Plate.

The internal spline of the P.D. Housing is then keyed with the Counter Body. After the Scroll is set in the zero position and the #3 Wheel of the Counter Assembly has the proper angular relationship with the Setting Gear Drive Plate, axial pressure on the P.D. Housing causes the spline coupling to slip axially allowing the P.D. Housing to snap lock into the groove of the Sleeve. Manual rotation of the P.D. Housing against the light torsional drag of the snap lock aligns the index line with the zero of the #3 Wheel. Tape is put on the P.D. Housing and Sleeve to hold the zero set in place until the heat staking operation.

4.3.3.3 Heat Stake P.D. Housing to Sleeve

Heat applied to a ledge on the P.D. Housing causes the Lexan material to flow into the slot in the Sleeve, preventing the P.D. Housing from rotating (See Figure 4-2).

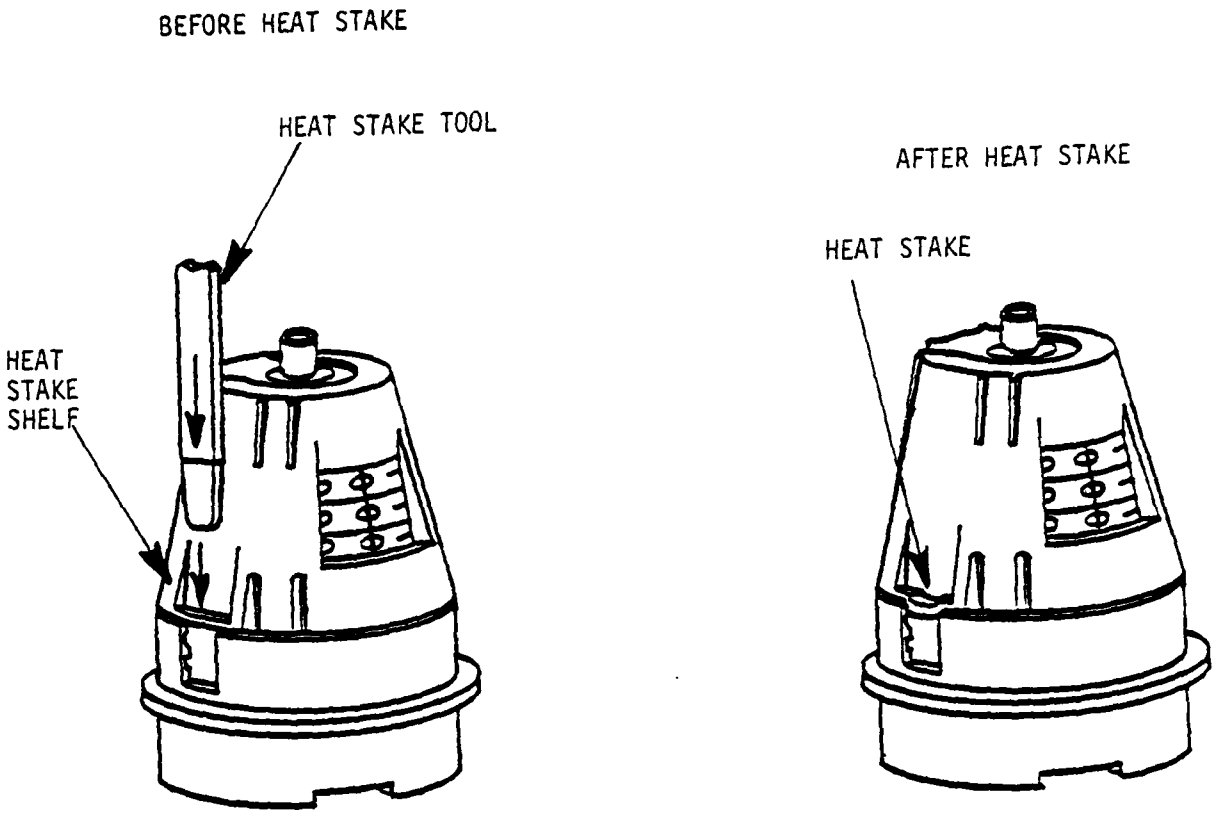


FIGURE 4-2 HEAT STAKE OPERATION

4.3.3.4 Assemble Spacer and Clutch Grip Spacers/Rings on Setting Shaft Knurl

The Spacer is assembled on the Setting Shaft knurl using a fixture whose punch fits inside the hole of the top of the P.D. Housing.

The Clutch Grip Rings and Spacers are assembled on the Setting Shaft the same as with the present design.

4.3.4 Loaded Three-Module Assembly

4.3.4.1 Assemble MDF

Since the P.D. Housing is already part of the Three-Module Assembly, a fixture which accommodates this assembly is used to assemble the MDF Tape. The MDF Tape is held to the sides of the P.D. Housing by aluminum tape, and the ends are assembled. to the Trigger Assembly as in the current design.

4.3.4.2 Assemble Detonator Holder and M55 Detonators

An inverted Detonator Holder is placed in a nest, and the inverted Three-Module Assembly is placed in a nest above it. The M55 Detonators are manually placed in the Detonator Holder. The legs of the Detonator Holder are slightly squeezed together, while the inverted Three-Module Assembly is lowered onto the Detonator Holder nest to snap the Detonator Holder legs into the P.D. Housing.

5 TESTING

5.1 Static Propagation Test

One hundred twenty (120) fuzes with the new design were built and tested per MIL-F-50983, Paragraph 3.7. One hundered sixteen (116) units functioned in accordance with the specification. Four (4) units did not function high order. Upon examination, it was evident that the M55 Detonators, the Mild Detonating Fuze, and the M94 Detonator did function properly, but the multi-purpose lead went low order. Upon further investigation and testing of two hundred twenty (220) units using standard production parts and new design parts, it was shown that the cause of the low order explosion was faulty multi-purpose leads. DCAS and HTI decided the results were acceptable because the elements being tested did function properly.

5.2 Jolt and Jumble Test

Twenty-four (24) fuzes with the new design were built and tested per MIL-STD-331, Tests 102.1 and 101.2. All units were examined after testing and found to be safe to handle.

5.3 Five-Foot Drop Test

Twenty-five (25) units with the new design were built and tested per MIL-STD-331, Test 111.2. These units were inspected, X-rayed, and then subjected to ballistic tests (See Section 5.4).

5.4 Ballistic Tests

Eighty-five (85) fuzes, including the twenty-five (25) units subjected to Five-Foot Drop Test (Section 5.3), were shipped to Yuma Proving Grounds, Yuma, Arizona and ballistically tested. The fuzes functioned perfectly in all phases except the 155mm, Zone 1, where there were five (5) duds out of 19 rounds. Table 5-1 shows the results of this test.

TABLE 5-1

GROUP	RESULTS
155mm, Zone 1, P.D. Function	14/19 functioned on target; 5 rounds hit the target and were duds which functioned ground impact; 1 round missed the target and functioned on ground impact.
105mm, Zone 7, Non-Function	0/20 Functioned
105mm, Zone 7, P.D. Function	20/20 Functioned
105mm, Zone 7, P.D. Non-Function (From Five-Foot Drop Test)	0/25 Functioned

5.5 Detonator Holder Heat Stake Test

Various laboratory tests were performed after the initial ballistic tests. It was discovered that the heat stake holding the Firing Plate on the Detonator Holder was weak compared to the present production assembly. After an investigation it was determined that the ribs on the new Detonator Holder interfered with the heat staking of the Firing Plate to the Detonator Holder. Pull-off tests on the heat stake were done with Detonator Holders that had ribs of various lengths. As shown in Table 5-2, present production units required a significantly larger load to break the heat stake than the new design.

TABLE 5-2

Description of Detonator Holder	Load Required to Break Heat Stake
Present Production	320g. or 11.28 oz.
New design with ribs .190" high (full height)	220g. or 7.75 oz.
New design with ribs .120" high	270g. or 9.52 oz.
New design with ribs .100" high	290g. or 10.22 oz.

5.6 Ballistic Retest

After testing (see Section 5.5), it was determined that the tops of the ribs on the Detonator Holder interfered with the heat staking of the Firing Plate to the Detonator Holder. The ribs on the Detonator Holder were decreased from .190" high to .120" high. Thirty (30) fuzes were built with the shortened ribs and shipped to Yuma Proving Grounds, Arizona and ballistically tested in the 155mm, Zone 1, P.D. function. The results were 29 out of 30 functioned. The dud did not function on ground impact and was recovered at a later date. Upon examination of the dud, it was found that the M55 Detonators and the Mild Detonating Fuze had fired normally. The S.S.D. was in the fully armed position, but the M94 Detonator had not fired.

6. COST AND WEIGHT

6.1 Cost Comparison

The total anticipated cost savings is $0.37 per fuze. This cost savings was calculated using a quantity of 300,000 units and the lowest price obtained from qualified vendors. Quotes from Mold-a-matic Corporation, Crescent Industries, Inc., and Plastimatic, Inc. were obtained for the new polycarbonate parts and from Cast Products, Inc., Fisher Gauge Limited, and Callen Manufacturing Corporation for the zinc die cast part. This cost savings was based on the lowest price obtained from qualified vendors for a quantity of 300,000 units and does not reflect the cost of the production tooling. A cost comparison of the present design and the new design is shown in Table 6-1.

The cost for production tooling for the new polycarbonate and zinc die cast parts, as quoted by the vendors, is $33,229. This cost assumes a four cavity mold which will be built for the polycarbonate parts and a five cavity mold for the zinc die cast part. The cost for new production assembly tooling needed is estimated to be $32,000 using current rates. The total costs for production tooling is $65,229.

TABLE 6-1 COST COMPARISON PER FUZE

	Present Design	Proposed Design	Savings
P.D. Housing	$ .1794	$ .0975	$ .0819
Ctr. Body	.1261	.0967	.0294
Detonator Holder	.0608	.0345	.0263
Sleeve	1.6869	1.7053	(.0184)
Hsg. Retainer	.0253	0	.0253
Ctr. Housing	.0807	0	.0807
Washer	.0221	0	.0221
Ctr. Hsg. Skirt	.0801	0	.0801
Ctr. Assy. Operations Elim.	.0485		.0485
Added Assy. Cost		.0048	(.0048)
TOTAL			$ .3711

6.2 Weight Comparison

A comparison of changed parts and subassemblies is given in Table 6-2. The weight change of the fuze for the new design is an increase of .0232 lb.

TABLE 6-2 WEIGHT COMPARISON

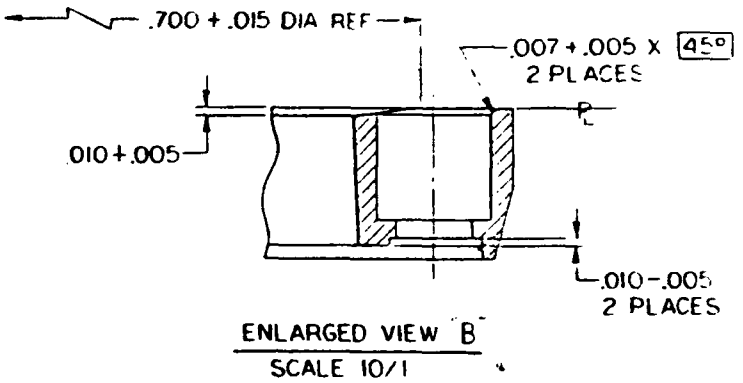
PART	PRESENT	PROPOSED	NET CHANGE
Sleeve	.0512	.0512	0
PD Housing	.0144	.0325	+ .0181
Counter Assy	.0515	.0565	+ .0050
Detonator Holder	.0016	.0017	+ .0001
		TOTAL	+ .0232

APPENDIX A

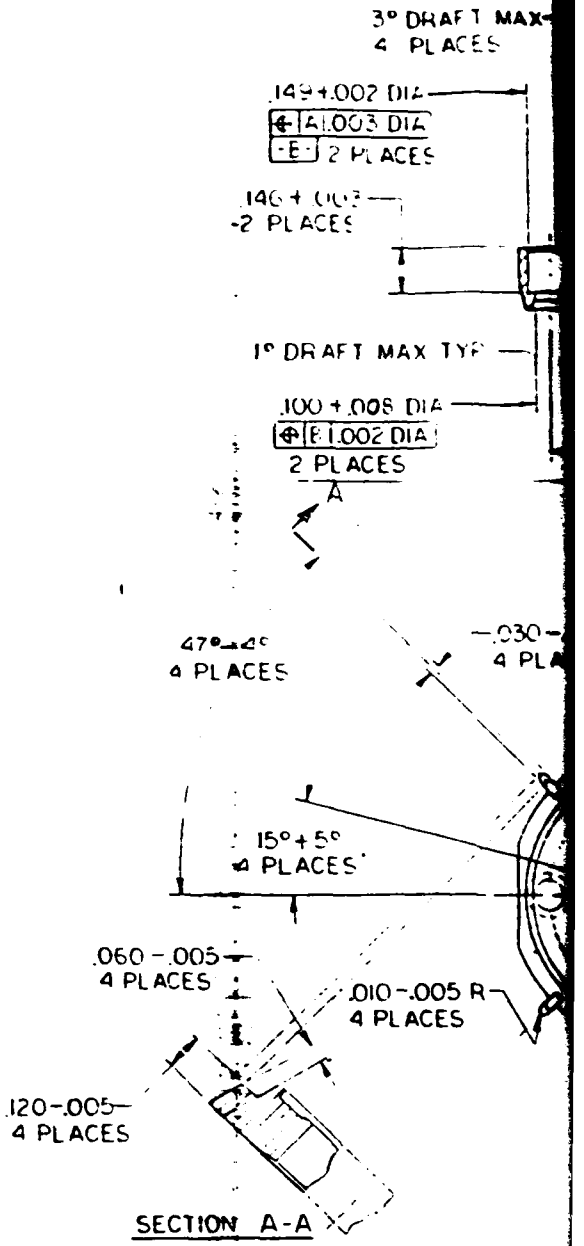
DRAWINGS

NOTES -

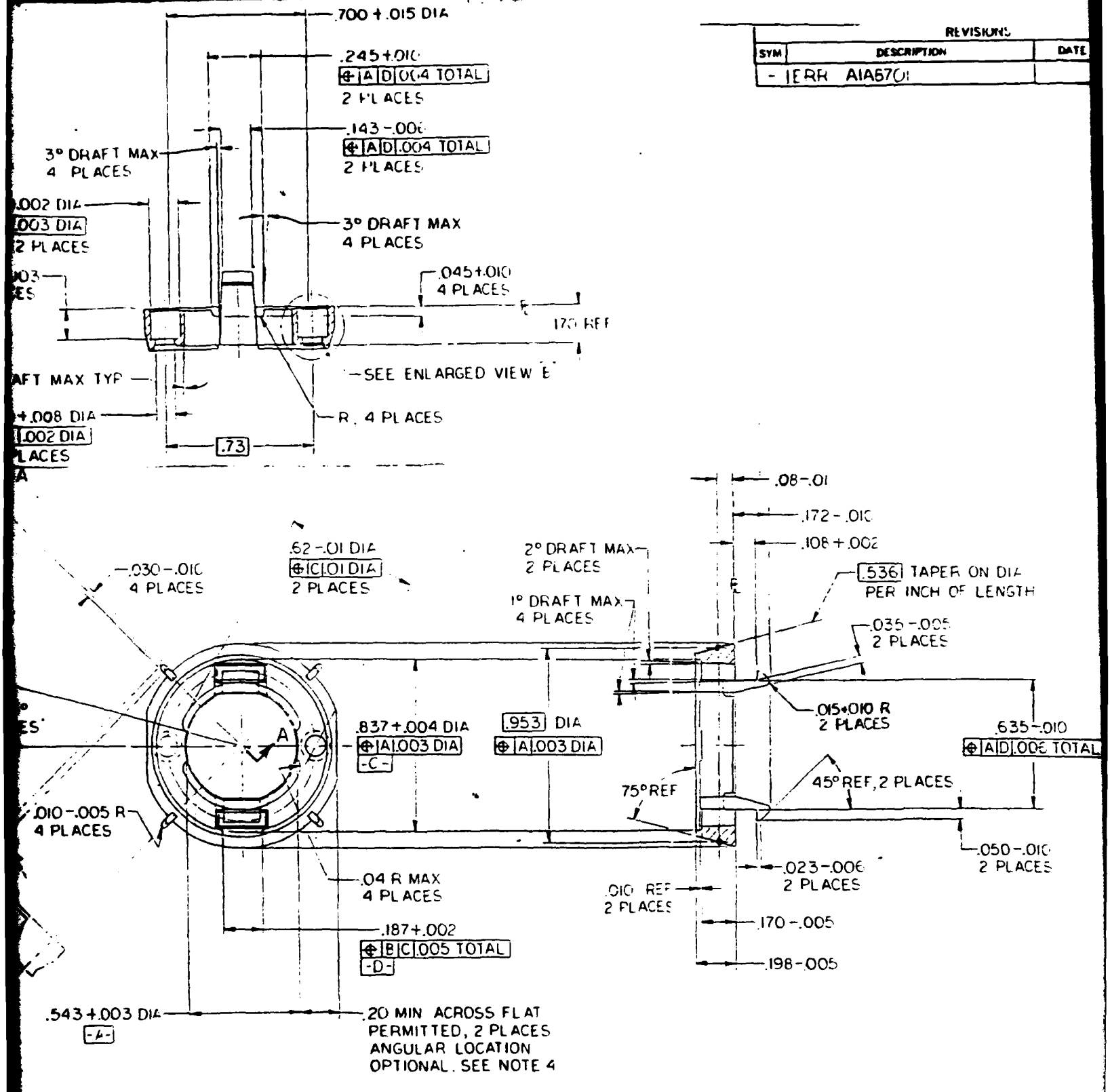
1 - SPEC MIL-A-2550 APPLIES
2 - MATERIAL - PLASTIC MOLDING MATERIAL, POLYCARBONATE INJECTION AND EXTRUSION, SPEC L-P-393
3 - 125/ ALL OVER
4 - GATE BURR PERMITTED
5 - INTERNAL AIR POCKETS AND/OR INCLUSIONS ARE PERMITTED PROVIDED INDIVIDUAL VOID AREAS ARE NOT WITHIN .05 OF SURFACES OR EACH OTHER AND ARE NOT LARGER THAN .07 DIA X .35 LONG.
6 - UNLESS OTHERWISE SPECIFIED, FILLETS ARE TO BE .005 R MAX AND CORNERS ARE TO BE .005 R MAX OR .005 X 45° BASIC



ENLARGED VIEW B
SCALE 10/1



SECTION A-A

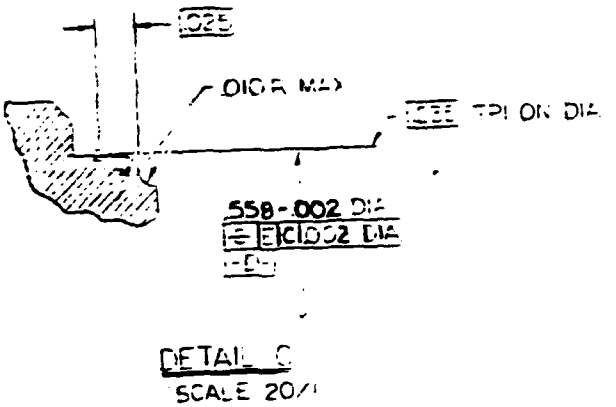


REVISIONS		
SYM	DESCRIPTION	DATE
-	ERR AIA67(1	

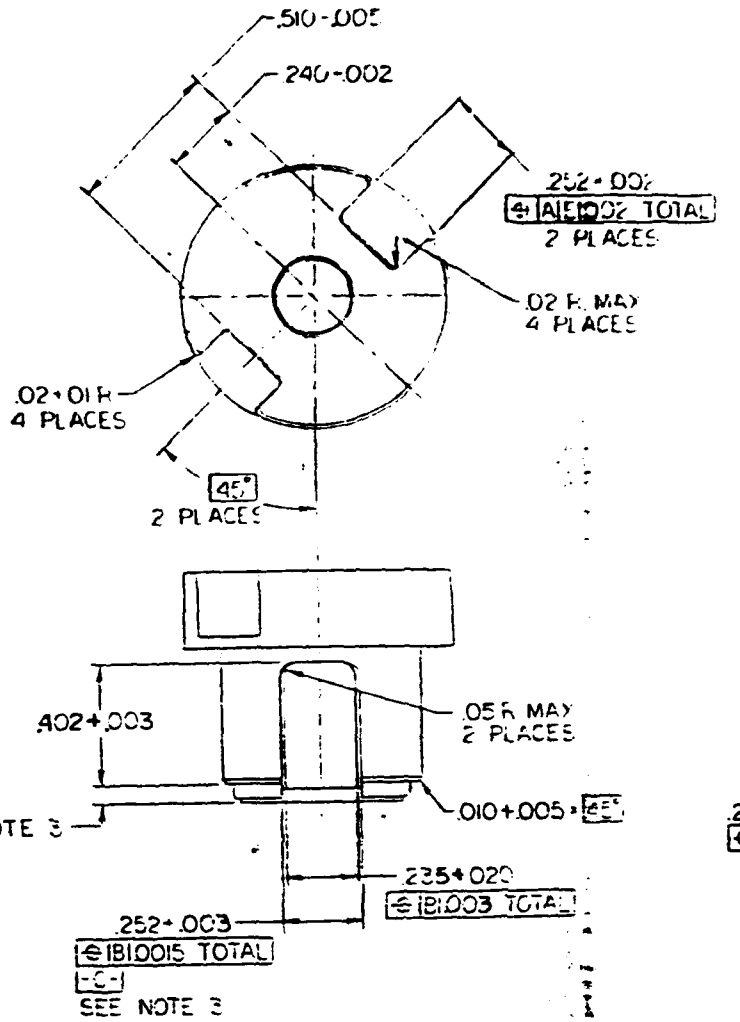
PART NO. 9345287

		DO NOT SCALE DRAWING	U S ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND	
	FUZE, M582			HOLDER, DETONATOR
3236561	FUZE, M577			
APPLICATION			SIZE F	CODE IDENT NO 19200 — 9345287
			SCALE 4/1	SHEET

A

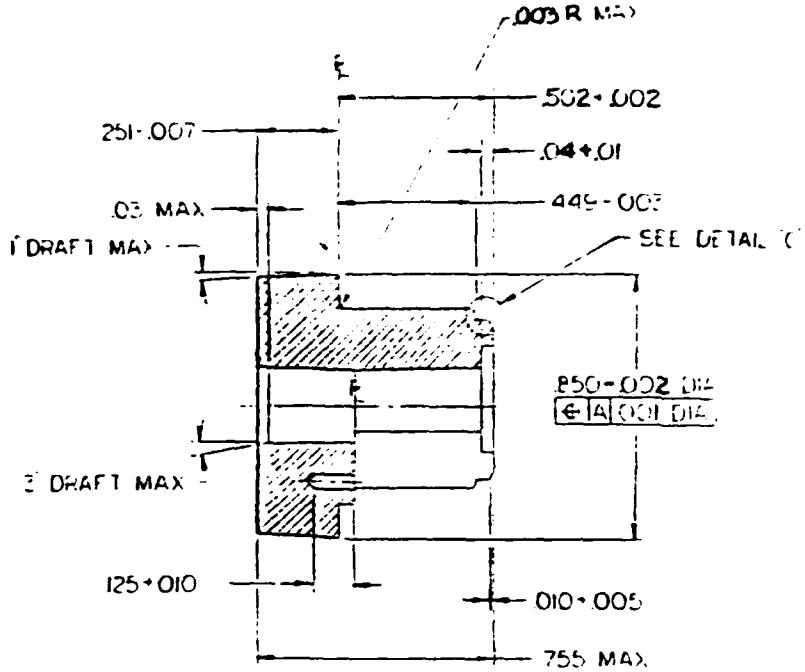


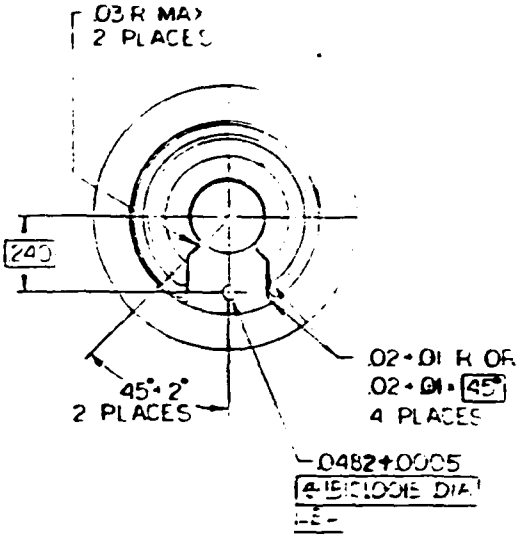
DETAIL C
SCALE 20/1

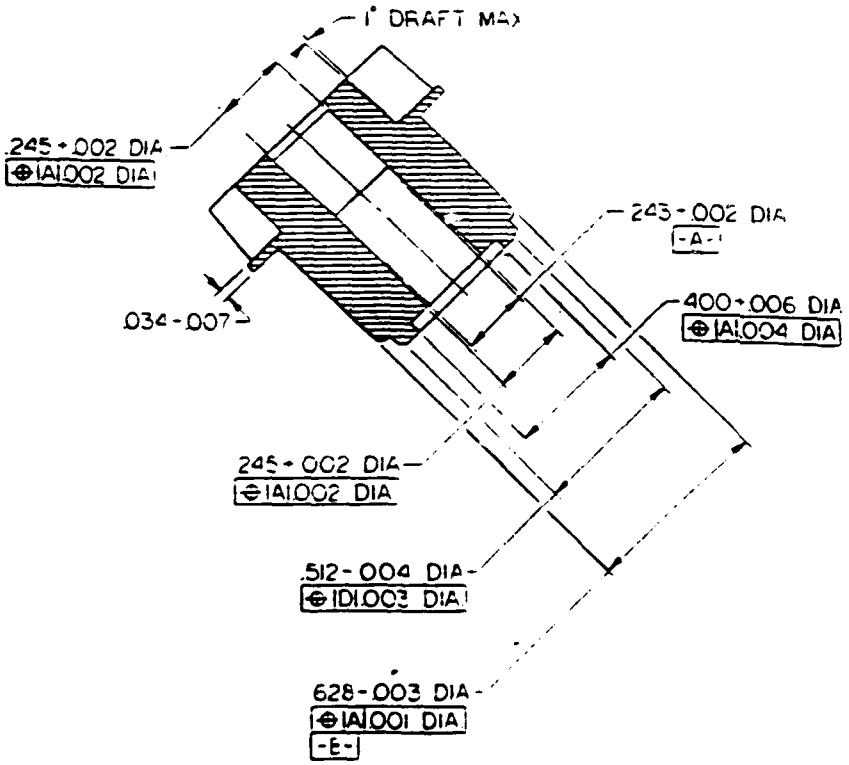


NOTES

1 - SPEC MIL-A-2550 APPLIES
2 - MATERIAL ZINC ALLOY, DIE CASTING, ALLOY AG 40A, ASTM B86
3 - DATUM-C-APPLIES TO INDICATED LENGTH
4 - UNLESS OTHERWISE SPECIFIED, FILLETS ARE TO BE .005 R MAX × 45° BASIC
5 - NO POROSITY SHALL BE VISIBLE ON ENTIRE SURFACE AREA
6 - PROTECTIVE FINISH. FINISH 612 OF MIL-STD-171, EXCEPT PART SHALL BE EXPOSED TO A SALT SPRAY FOR A MINIMUM OF 24 HOURS IN LIEU OF 96 HOURS PER PARA 443 OF MIL-T-12879.
7 - DRAFT PERMITTED WITHIN SPECIFIED TOLERANCES

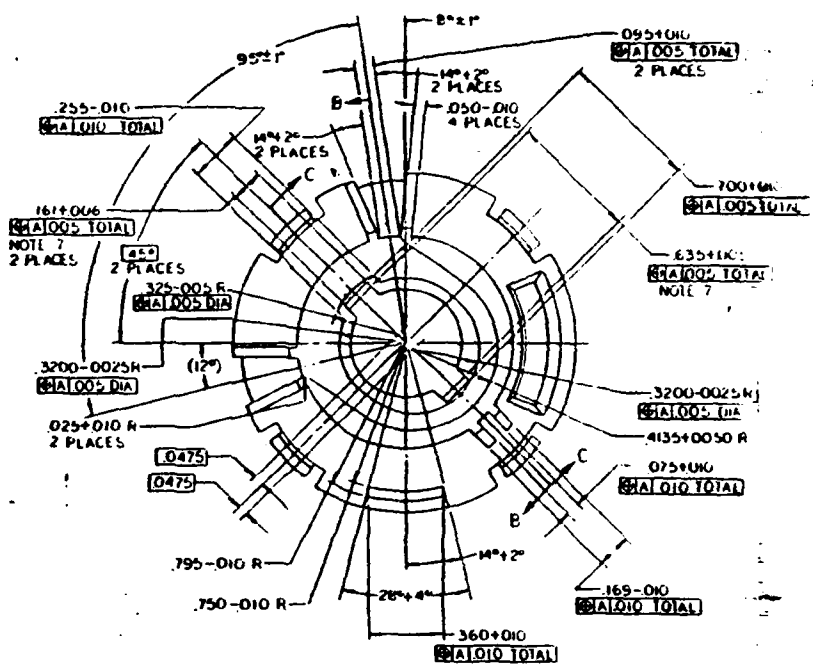






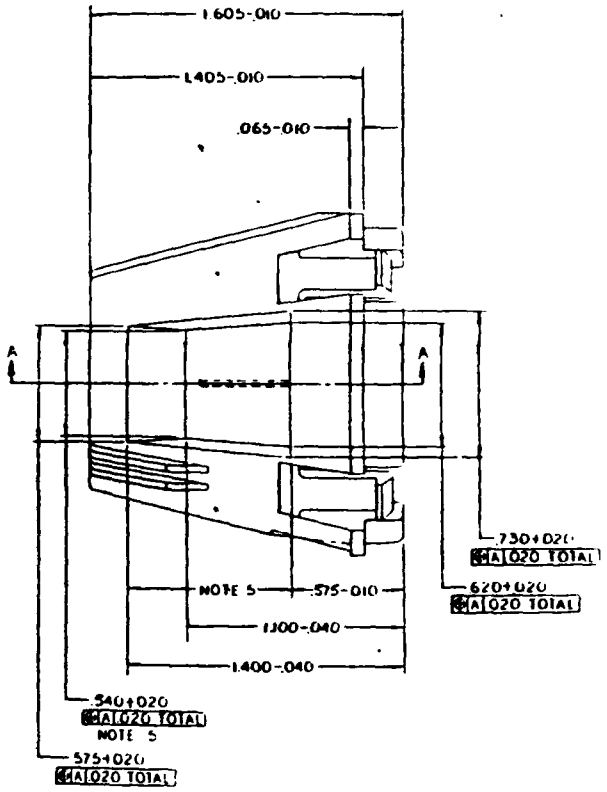
PART NO. 9345286

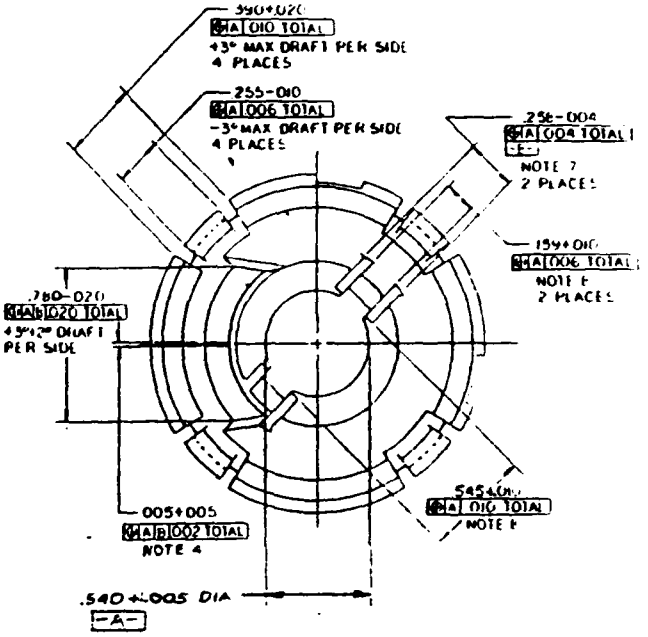
					BODY, COUNTER
	FUZE, M582				
9236574	FUZE, M577			F	19200 9345286



NOTES -

1- SPEC MIL-A-2550 APPLIES.
2- MATERIAL - PLASTIC MOLDING MATERIAL, POLYCARBONATE INJECTION AND EXTRUSION, SPEC L-P-395
3- 63% ALL OVER
4- GROOVE TO BE COLORED WITH INK, STENCIL, BLACK, NO. 37038, TYPE I, SPEC TT-I-1795.
5- .15 HIGH X .09 WIDE X .015 THICK GOTHIC NUMBERS AND SYMBOL MUST BE CLEARLY READABLE WITHOUT DISTORTION WHEN SPACED .12 AWAY FROM INSIDE DIAMETER AND SIGHTED THROUGH WINDOW AREA SHOWN.
6- ALL EDGES SHOWN SHARP MUST HAVE .015 MAX R, EXCEPT AS NOTED. ALL FILLETS SHOWN SHARP MUST HAVE .030 MAX R, EXCEPT AS NOTED EDGES OF ALL HOLES AND SLOTS MUST BE SHARP WITHIN .010 MAX EXCEPT AS NOTED
7- THIS DIMENSION MAY BE INCREASED TO PERMIT .017/INCH MAX DRAFT PER SIDE
8- THIS DIMENSION MAY BE DECREASED TO PERMIT .017/INCH MAX DRAFT PER SIDE
9- DRAFT PERMISSIBLE WITHIN SIZE TOLERANCE SHOWN UNLESS OTHERWISE NOTED





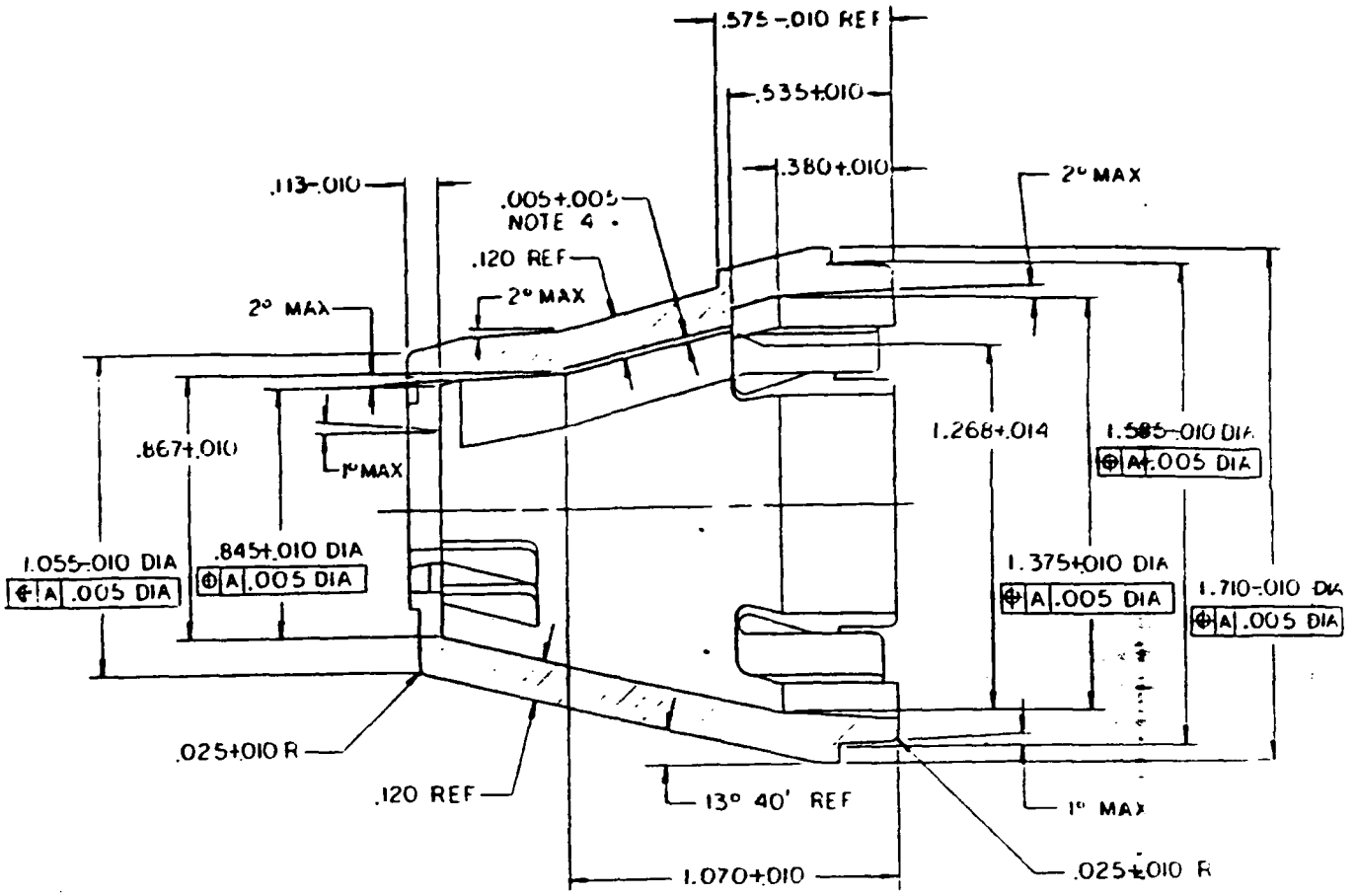
-	-
SHEET 1	SHEET 2
REVISION STATUS OF SHEETS	

PART NO 9345285

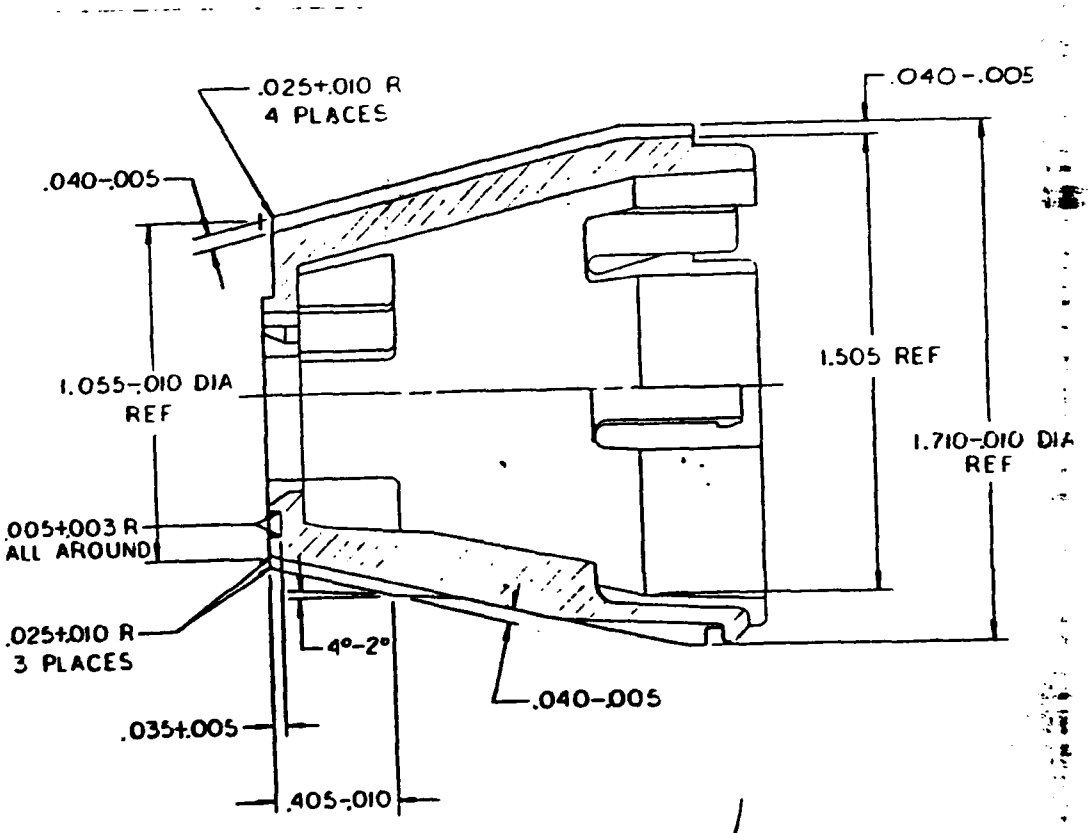
HOUSING, PD

F | 19200 | 9345285

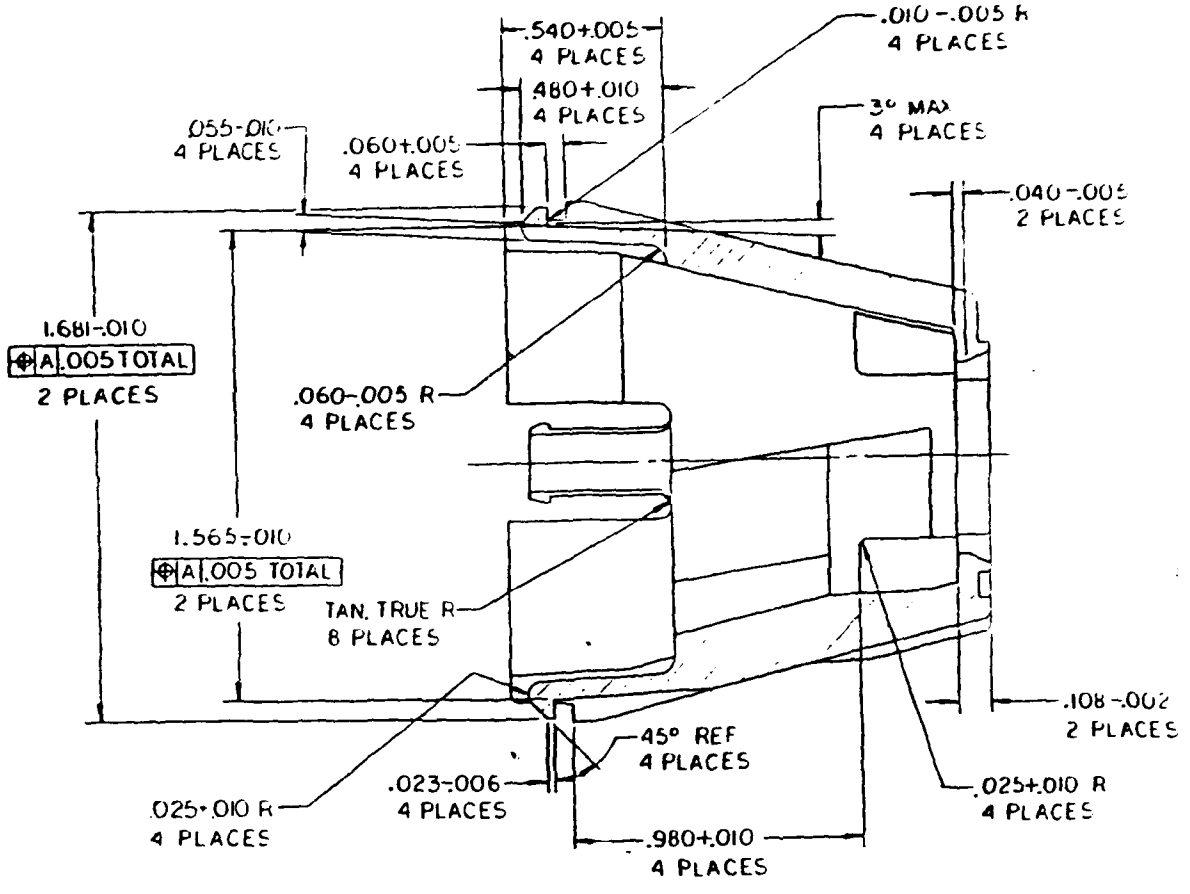
SHT 1 OF 2



SECTION A-A



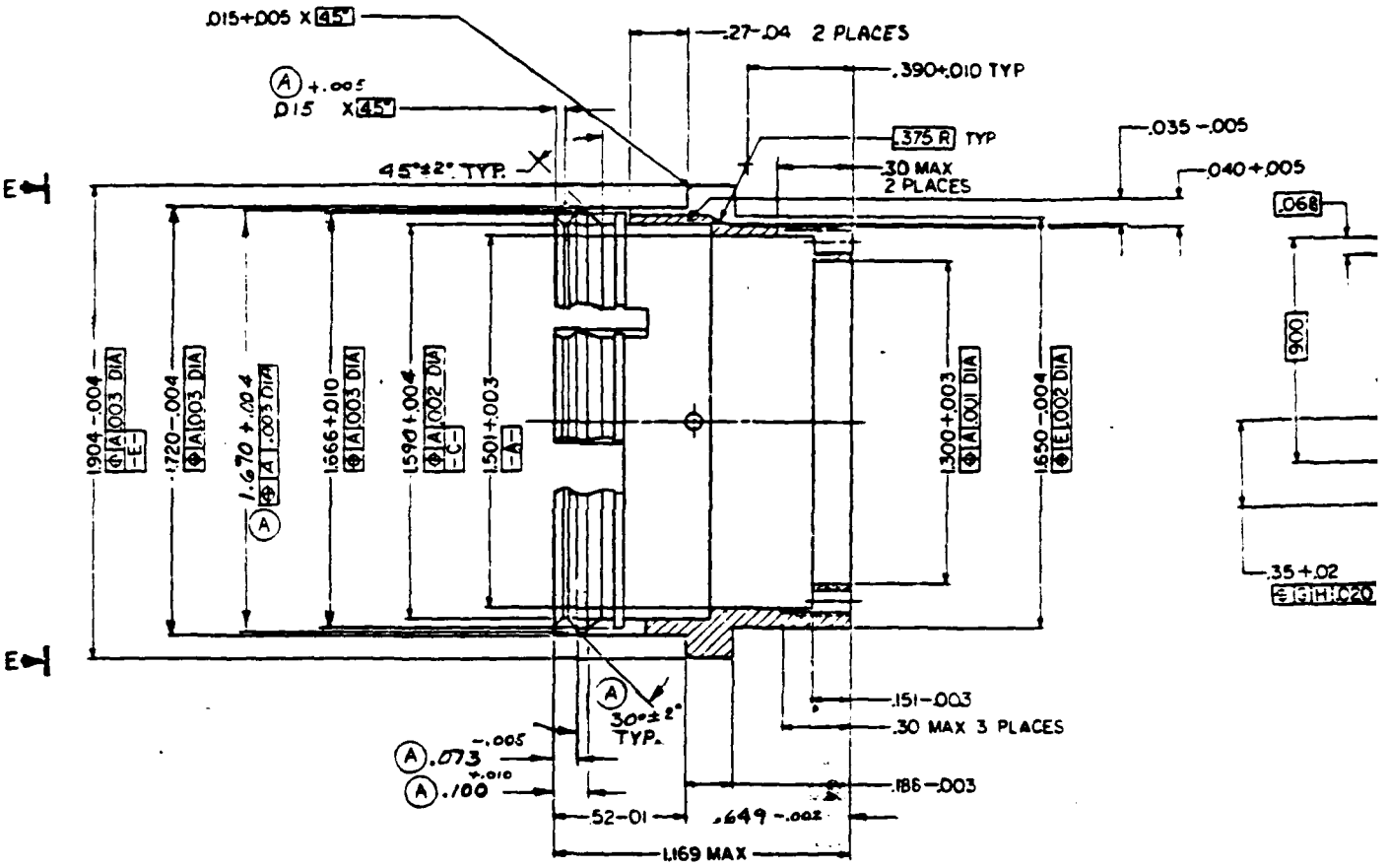
SECTION B-B



SECTION C-C

PART NO. 9345265

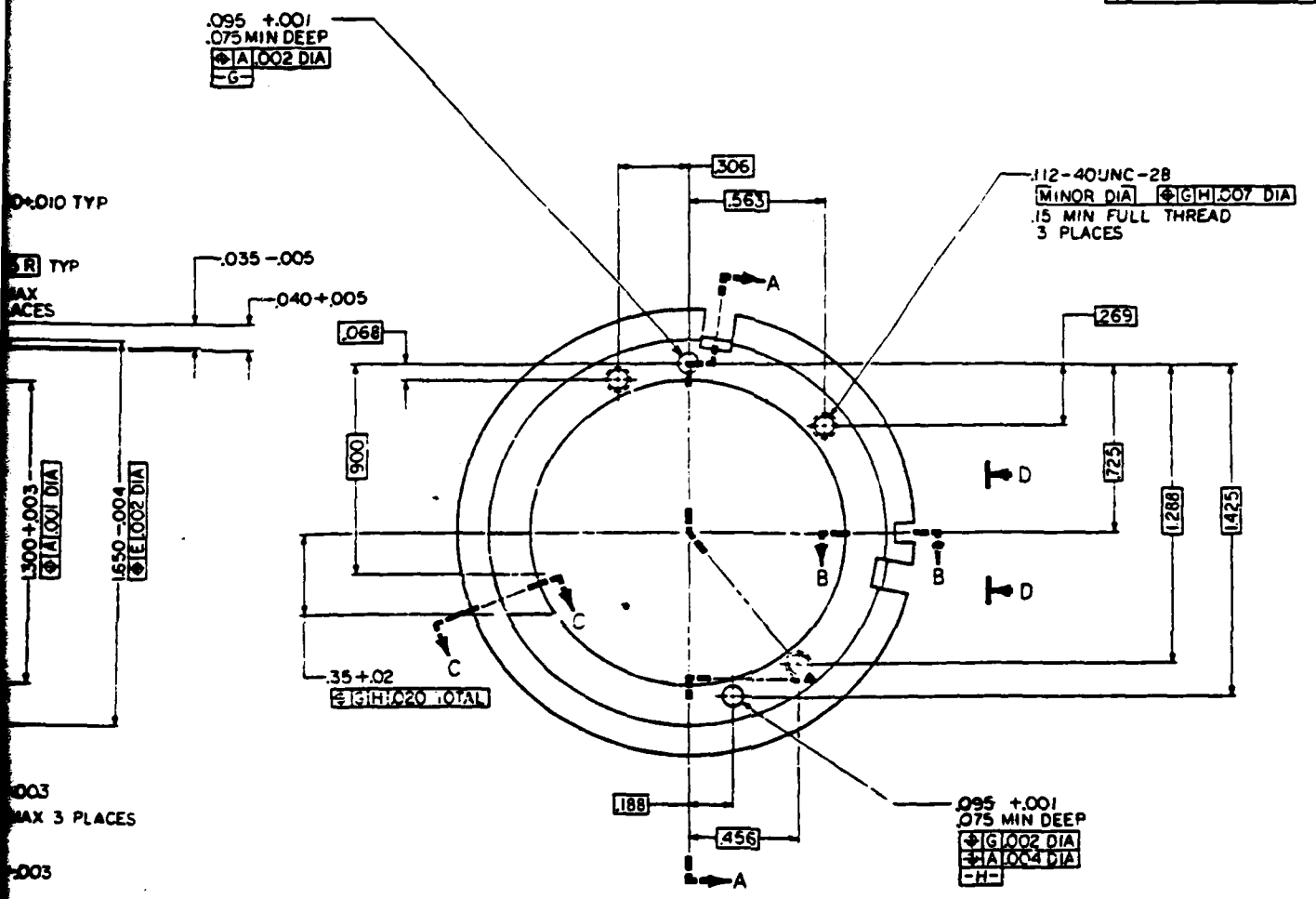
		DO NOT SCALE DRAWING		US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND, DOVER, NEW JERSEY 07801	
	FUZE, M582			HOUSING, PD	
92-6569	FUZE M577			SIZE F / 19200 / 9345265	
				SCALE 4/1	SHEET 2 OF 2



SECTION A-A

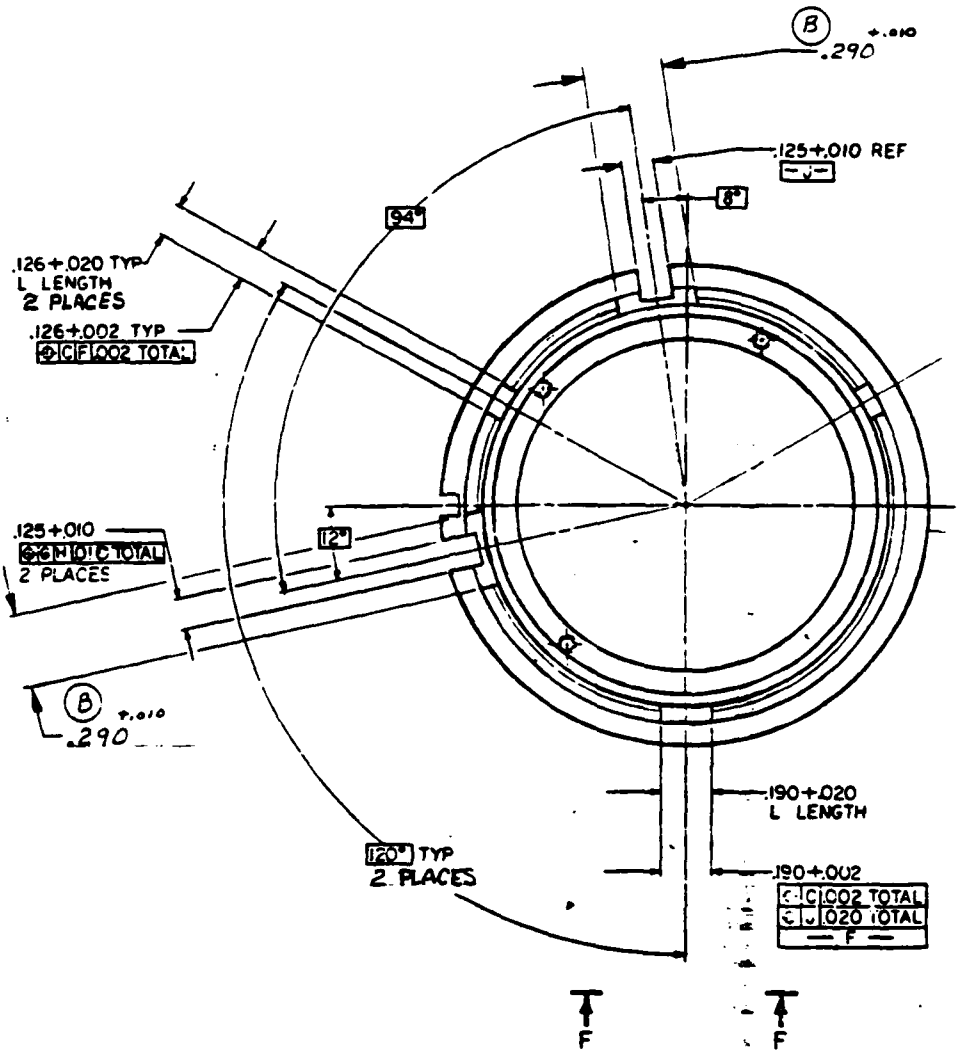
NOTES.—
1—FOR SECTIONS, VIEWS, AND NOTES SEE SHEET 2 OF 2.

REVISIONS			
NO.	DESCRIPTION	DATE	APPROVED
N/A	REVISED	3/28/80	BJ / DL
A	REVISED	5/13/80	BJ / DL



PART NO.

DO NOT SCALE DRAWING	3-28-80		SLEEVE	
	DRAWN PLS	CHECKED DL		
	ENGR D.S.	DATE		
	APPD. DL	DATE		
			SIZE F	005242
			SCALE 4/1	SHEET 1 OF 2



VIEW E-E

NOTES:-

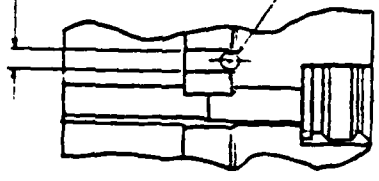
1- SPEC MIL-A-2550 APPLIES.
2- MATERIAL:- ALUMINUM-ALLOY. DRAWN SEAMLESS TUBES. ALLOY 2024-T3, ASTM B210.
3- ALTERNATIVE MATERIAL:- ALUMINUM-ALLOY. BARS, RODS AND WIRE. ALLOY 2024-T351, ASTM B211.
4- ALTERNATIVE MATERIAL:- ALUMINUM-ALLOY EXTRUDED BARS, RODS, SHAPES AND TUBES. ALLOY 2014-T6. ASTM B221.
5- ALTERNATIVE MATERIAL:- ALUMINUM-ALLOY. DIE AND HAND FORGINGS. ALLOY 2014-T6. ASTM B247.
6- UNLESS OTHERWISE SPECIFIED FILLETS ARE TO BE .005 R MAX AND CORNERS ARE TO BE .005 R MAX OR .005 MAX X 45° BASIC.
7- 125 ALL OVER.
8- DIMENSION APPLIES TO .126+.002 AND .190+.002 SLOTS.

SYMBOL	DESCRIPTION	DATE	APPROVED
–	EARLY RELEASE-1 PIECE	12-27-79	
A	REVISED	2/20/80	
B	REVISED	5/9/80	

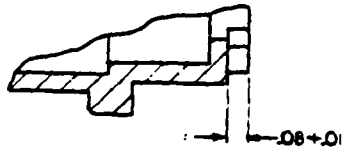
.096 +.002
B .004 DIA

.084 +.002
E .004 TOTAL
B .020 TOTAL
— B —

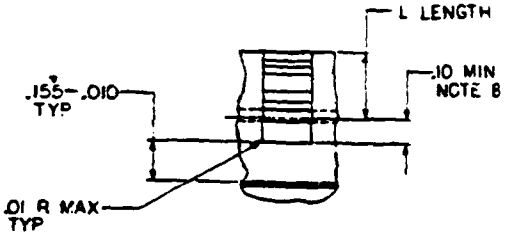
REF



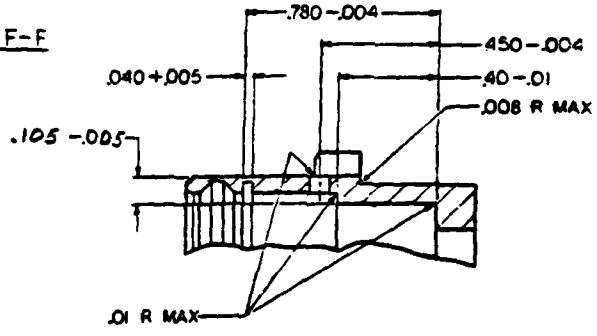
VIEW D-D



SECTION C-C



VIEW F-F



SECTION B-B

STM B210.
24-T351, ASTM B211.
TUBES, ALLOY 2014-T6, ASTM B221.
2014-T6, ASTM B247.
NERS ARE TO BE .005 R MAX OR

PART NO.

	MECHANICAL PROPERTIES	DO NOT SCALE DRAWING	3-26-80	SLEEVE
				F 005242
				SCALE 4/1 SHEET 2 OF 2

APPENDIX B

FAULT ANALYSIS

78 PIP TASK 4 FAILURE MODE ANALYSIS

Part	Purpose	Failure Mode	Failure Class	Effect of Failure	Cause of Failure
Detonator Holder	Functional part of design identical to present design		Major		
Detonator Holder Assy.	Provides charge for MDF tape	Detonators do not initiate	Major	Point detonation dud	Improper stake of Firing Plate to Detonator Holder
PD Housing & Counter Housing Cover	Provide viewing window for setting; provide channels for MDF tape	Indicator line or line on #3 wheel is not visible to the fuze setter	Major	Nonsettable Fuze	Painting of line omitted or plastic is not clear enough to see through
Sleeve	Provides groove for PD Housing legs	Groove not properly made	Major	PD Housing cannot be properly assembled	Missing groove or improperly cut groove
Three Module Assembly	Contains most of the functional parts of fuze	M55 Detonators do not function	Major	PD dud	Detonator Holder improperly assembled to Three Module Assy
		MDF tape does not carry charge to SSD	Major	PD dud	Break in MDF tape from improper assy of tape or Detonator Holder Assembly to PD Housing
		PD Housing rotates after zero setting	Major	Slow or fast time on airburst	PD Housing not properly heat staked
Fuze Assy	Initiate booster charge	M55 Detonators do not initiate or MDF tape does not carry charge	Major	PD dud	Improper assy of Three Module Assembly in Ogive

APPENDIX C

BALLISTIC TEST REPORTS

DEPARTMENT OF THE ARMY
U.S. Army Yuma Proving Ground
Yuma, Arizona 85364

18 DEC 1980

FIRING REPORT NO. 14906

Fuze, MTSQ, M577

Dates of Firing: 19 and 20 November 1980

Manufacturer: Hamilton Technology Inc, Lancaster, PA

Authority: Letter, TECOM, DRSTE-TO-O, dated 9 January 1979

TPR LCN-T-2341, Supplement No. 34

Product Improvement Test

TECOM Project No. 2-MU-007-577-033
k/ltv

1. ITEM UNDER TEST

Fuze, MTSQ, M577, lots No. HAT80J000E029 and HAT80J000E034

2. SUPPORTING MATERIEL AND EQUIPMENT

2.1 AMMUNITION

Propelling Charge, 155-mm, M3A1, lot No. RAD-69193
Propelling Charge, 105-mm, M67, lot No. IND-9-6
Projectile, 155-mm, M107, Inert, lot No. DFP-1-137
Projectile, 105-mm, M1, Inert, lot No. KN-SR-4
Charge, Supplementary, T-2, lot No. IOP-5-2
Pellet, Tetryl, A5, lot No. MA78K00E129
Case, 105-mm, M14B4, lot No. KXO-13-331
Fuze, Spotting, M78, lot No. DM-38

2.2 WEAPON

Carriage, 105-mm, M108, Self-propelled, serial No. 12U887
Recoil Mechanism, XM139, serial No. 227
Gun, 105-mm, XM103, serial No. 241
Tube, 105-mm, M103, serial No. 62337

Carriage, 155-mm, M1A1, Towed, serial No. 1042
Recoil Mechanism, M6, serial No. 5203
Gun, 155-mm, M1A1, serial No. 7456
Tube, 155-mm, M1A1, serial No. 11157

2.3 EQUIPMENT

Polaroid camera
Plywood targets

3. OBJECTIVE

To ballistically test special lots of fuzes which have a new optimized point detonating housing assembly and to check the new assembly for functioning or nonfunctioning on plywood targets.

4. PROCEDURE

The test was conducted in accordance with Supplement 34 to TPR-2341 (Incl 1) as follows:

Fuze Group	Fuze Set	Target Distance from Muzzle (ft)	Phase
A	PD	150	Nonfunction
B	PD	820	Function
C	PD	820	Function
D	PD	150	Nonfunction

Polaroid photographs were made of each test fuze setting. All targets were constructed of 2-inch plywood. All test fuzes were x-rayed prior to firing.

5. RESULTS

Group	Fuze Lot No.	Results
A (105-mm)	HAT80J000E029	No functions
B (105-mm)	HAT80J000E029	All rounds functioned on target
C (155-mm)	HAT80J000E029	14 rounds functioned on target; 5 rounds hit the target and were duds which functioned ground impact; 1 round missed the target and functioned ground impact.
D (105-mm)	HAT80J000E034	All rounds hit the target; no functions

Chamber pressures recorded for each group follow (psi/100):

Group A	Group B	Group C	Group D
392	396	65	392 393
394	389	65	394 390
381	393	64	381 386
382	386	65	382 387
382	386	66	382 384
383	389	66	383
384	388	66	384
382	389	65	382
386	394	65	386
382	394	64	382
389	394	65	389
388	391	65	388
380	394	65	380
380	381	65	380
386	396	64	386
391	396	63	391
390	384	65	390
387	394	66	387
380	401	64	380
385	401	63	385

6. OBSERVERS

Mr. L. Lerro, U.S. Army Armament Research and Development Command, Dover, NJ
Mr. E. Potts, Hamilton Technology, Inc, Lancaster, PA

SUBMITTED:

Harold G. Eades
HAROLD G. EADES
Project Engineer

REVIEWED:

for Graham Stullenbarger
WILLIAM T. VOMOCIL
Chief, Munitions and Weapons Engineering Branch

APPROVED:

WILLIAM L. SNIDER
Chief, Test Engineering Division

2 Incl
1. TPR, Supplement 34
2. Distribution List

TPR, SUPPLEMENT 34

COPY

R 011400Z OCT 80
FM CDR ARRADCOM DOVER NJ //DRDAR-LCN-T//
TO RUWJHUA/CDRYPG YUMA AZ//STEYP-MTD//
INFO RUCIAFB/CDRARRCOM ROCK ISL IL //DRSAR-LEW//
BT
UNCLAS
FOR W. VOMOCIL, R. BARTLETT
SUBJ: SUPPLEMENT 34 TO TPR-2341
1. REQUEST THE FOLLOWING BALLISTIC TEST TO BE CONDUCTED ON EIGHTY-FIVE (85) EACH M577 FUZES FROM HAMILTON SPECIAL ENGINEERING LOTS HAT-80J000E029 AND HAT-80J000E034. THE ABOVE LOTS TO BE FIRED AS FOLLOWS:
A. 105-MM, M103, ZONE 7, PLUS 70 DEGREES, PD, NON-FUNCTION, 20 EA - HAT-80J000E029.
B. 105-MM, M103, ZONE 7, PLUS 70 DEGREES, PD, FUNCTION, 20 EA - HAT-80J000E029.
C. 155-MM, M1, ZONE 1, PLUS 70 DEGREES, PD, FUNCTION, 20 EA - HAT-80J000E029.
D. 105-MM, M103, ZONE 7, PLUS 70 DEGREES, PD, NON-FUNCTION, 25 EA - HAT-80J000E034.
2. THE FOLLOWING DATA WILL BE RECORDED FOR ALL ROUNDS:
PEAK CHAMBER PRESSURES
3. ADDITIONAL REQUIREMENTS:
A. POLAROID PHOTO (FUZE SETTINGS)
B. X-RAY ALL FUZES
4. HAMILTON PERSONNEL WILL WITNESS TEST.
5. FUNDS ARE AVAILABLE UNDER SUBJECT TPR.
6. SPECIAL FUZE LOT ASSEMBLED WITH OPTIMIZED PD HOUSING ASSEMBLY.
7. PER AR-200-1 THE EIA ACTION IS NOT MAJOR. A SIGNIFICANT ENVIRONMENTAL IMPACT WILL NOT RESULT FROM THE ACTION AND THE IMPLEMENTATION OF THE PLAN OR ACTION WILL NOT BE ENVIRONMENTALLY CONTROVERSIAL.
BT
#2613

Incl 1

DISTRIBUTION LIST

NAME AND ADDRESS	NO. OF COPIES
Commander U.S. Army Armament Research and Development Command ATTN: DRDAR-LCF-T Dover, NJ 07801	3
Commander U.S. Army Test and Evaluation Command ATTN: DRSTE-CM-F Aberdeen Proving Ground, MD 21005	1
Hamilton Technology, Inc. ATTN: Mr. E. Landis P.O. Box 1609 Columbia Boulevard Lancaster, PA 17604	2
Director U.S. Army Ballistic Research Laboratories ATTN: DRDAR-TSB-S Aberdeen Proving Ground, MD 21005	2
Commander U.S. Army Yuma Proving Ground ATTN: STEYP-MTW STEYP-MSA-TL STEYP-MTE Yuma, AZ 85364	3 1 1

Incl 2

1 MAY 1981

DEPARTMENT OF THE ARMY
U.S. Army Yuma Proving Ground
Yuma, Arizona 85364

FIRING REPORT NO. 81-PI-0059-L5

Fuze, MTSQ, M577

Date of Firing: 19 March 1981

Manufacturer: Hamilton Technology Inc, Lancaster, PA

Authority: Letter, TECOM, DRSTE-TO-O, dated 9 January 1979

TPR-2341, Supplement No. 44

Product Improvement Test

TECOM Project No. 2-MU-002-577-033
k/ltv

1. ITEM UNDER TEST

Fuze, MTSQ, M577, lot No. HAT 81B000-E047

2. SUPPORTING MATERIEL AND EQUIPMENT

2.1 AMMUNITION

Projectile, 155-mm, M107, Inert Loaded, lot No. LOP-78G0-015-004
Charge, Propelling, M3A1, lot No. RAD-69193
Charge, Supplementary, T-2, lot No. IOP-5-2
Booster, Cup, with Pellet, Tetryl, A5, lot No. MA79K000-E217
Fuze Bodies, M78, lot number mixed
Primer, Percussion, M2A4, lot No. LS-186-15

2.2 WEAPON

Carriage, 155-mm, M1A1, Towed, serial No. 1042
Recoil Mechanism, M6, serial No. 5203
Gun, 155-mm, M1A1, serial No. 7456
Tube, 155-mm, M1A1, serial No. 11157

2.3 EQUIPMENT

Geodetic equipment
X-ray equipment
Polaroid camera
Conditioning chambers
Plywood targets

3. OBJECTIVE

To test a special lot of fuzes, assembled with an optimized point detonating housing assembly, for functioning against a plywood target.

4. PROCEDURE

The test was conducted, in accordance with Supplement 44 to TPR-2341, as follows:

Target Distance (ft)	Fuze Setting	Phase
820 ±5	PD	Function

Polaroid photographs were made of each test fuze setting. All targets were constructed of 2-inch plywood. All fuzes were x-rayed prior to firing.

5. RESULTS

Fuze No. 8 (tube round No. 5135) failed to function on target impact. The round was recovered for fuze disassembly and examination by ARRADCOM representative. All other fuzes functioned.

6. OBSERVERS

Mr. L. Lerro, U.S. Army Armament Research and Development Command, Dover, NJ
Mr. E. Potts, Hamilton Technology, Inc, Lancaster, PA

SUBMITTED:

MICHAEL J. SHAFER
Project Engineer

REVIEWED:

WAYNE L. TAYLOR
Acting Chief, Munitions and Weapons Engineering Branch

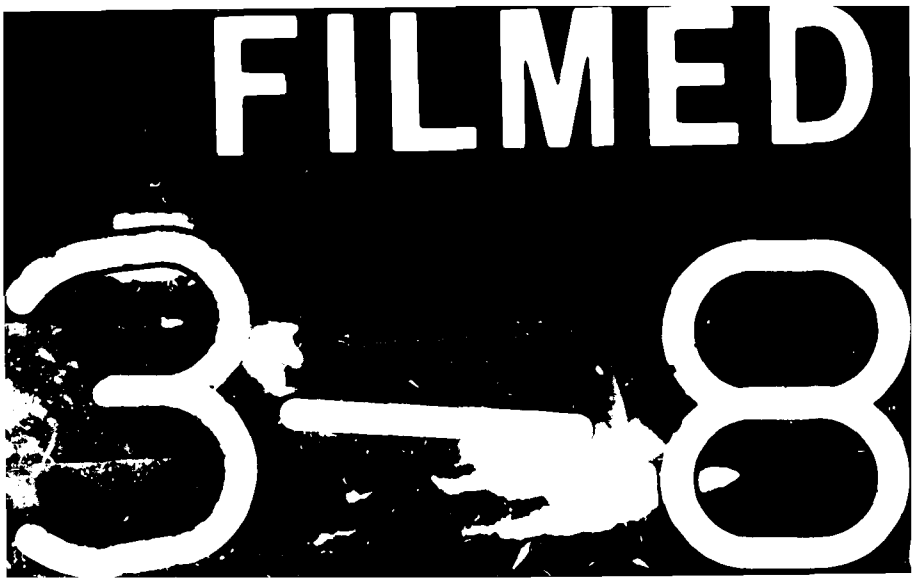
APPROVED:

WILLIAM L. SNIDER
Chief, Test Engineering Division

DISTRIBUTION LIST

NAME AND ADDRESS	NO. OF COPIES
Commander U.S. Army Armament Research and Development Command ATTN: DRDAR-LCF-T Dover, NJ 07801	3
Commander U.S. Army Test and Evaluation Command ATTN: DRSTE-CM-F Aberdeen Proving Ground, MD 21005	1
Director DCASR, Philadelphia ATTN: DCRP-DRQ P. O. Box 7478 Philadelphia, PA 19101	1
Hamilton Technology, Inc ATTN: Mr. E. Landis P. O. Box 1609 Columbia Boulevard Lancaster, PA 17694	2
Director U.S. Army Ballistic Research Laboratories ATTN: DRDAR-TSB-S Aberdeen Proving Ground, MD 21005	2
Commander U.S. Army Yuma Proving Ground ATTN: STEYP-MTW STEYP-FIO-TL STEYP-MTE Yuma, AZ 85364	3 1 1

Incl 1


FILMED
8